DOCUMENT RESUME

ED 463 175 SE 065 866

AUTHOR Bumbaca, Leonard
TITLE Give Me a Hand! Digitizing Images into a Graphing Calculator Using Coordinate Geometry.
PUB DATE 2001-03-00
NOTE 17p.; Paper presented at the Annual International Teachers Teaching with Technology Conference (13th, Columbus, OH, March 16-18, 2001).
PUB TYPE Guides - Classroom - Learner (051) -- Reports - Descriptive (141)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Algebra; *Analytic Geometry; *Functions (Mathematics); Geometric Concepts; *Graphing Calculators; *Mathematics Activities; Mathematics Education; Secondary Education

ABSTRACT

This paper describes a classroom, instructor-led activity designed to show how graphic calculators can be used to explore coordinate geometry. The activity involves digitizing an image of a hand and transforming the image through geometrical transformations. Teaching notes and calculator instructions are included as are blackline masters. Also included are Internet links to related resources. A vocabulary list student worksheet, table of coordinate points student worksheet, and a teacher's assessment rubric are appended. (MM)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 463 175

Give Me a Hand!

by

Leonard Bumbaca

L. Bumbaca

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

SE 065 866

BEST COPY AVAILABLE

Title

Give Me a Hand!

Digitizing Images into a Graphing Calculator Using
Coordinate Geometry

Overview

Topic: Graphing, coordinate geometry, digitization

The lesson is a hands-on activity in which students trace their handprint onto graph paper, assign coordinates to selected points, and enter those coordinates into a table in a graphing calculator. The student will then plot the points on the graph and use the image as feedback to correct the data entered. This image can be manipulated through various transformations as the students discover the effects of various numerical transformations on the coordinate pairs. The final image will be saved and linked to a desktop computer from which it can be printed.

Grade Level

The lesson is appropriate for students in grades six through eight (pre-algebra).

Length of the Lesson

One 75 minute lesson, or two 40 minute lessons.

Video/Technology Hardware and Software

TI-83 Graphing Calculator with overhead screen adapter
TI-83 Overhead Screen
TI-83 Graphing Calculators (one per student)
Low Heat Overhead Projector
Desktop Computer (Windows or MAC)
Computer printer
TI Calculator *Graph Link**
TI Calculator *Graph Link* Software*
Geometer's Sketchpad and image editing software (e.g. *Paint Shop Pro*)

*If linking data to the computer through *Graph Link*.

Learning Objectives

The main content goals of the lesson are to reinforce coordinate graphing skills, introduce transformations, and develop problem-solving skills through the use of technology.

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

SE 053 810

The student will be able to:

- Assign coordinates to at least fifteen points of a traced image.
- Correctly input coordinates into a table and manage modified information on a graphing calculator.
- Use visual feedback to correct their own work.
- Dilate an image using proportions, fractions, positive and negative integers, and percents.
- Rotate and reflect an image through sign changes and transposition of x and y coordinates.
- Translate an image by applying functions to x and y coordinates.
- Transfer this information to a desktop computer for printing or pasting into a document.

This lesson addresses National Curriculum and Evaluation Standards for School Mathematics (NCTM 1989) four and twelve (Mathematical Connections and Geometry) in grades five through eight. It also addresses Math 7 and Math 8 Standards of Learning (Virginia Board of Education 1995) as listed:

Patterns, Functions, and Algebra	Number and Number Sense	Geometry
		MAT.8.9
MAT.7.26	MAT.7.6	MAT.8.18
	MAT.8.1	MAT.8.1

Assessment

Student learning will be assessed using the attached rubric:

Materials and Teacher Preparations

For the teacher:

- Full size transparency with grid pattern (one per class/section)
- Overhead transparencies of Worksheets: " Vocabulary Terms"; "Table of Coordinate Points" (one of each per class/section)
- Overhead markers (two-four colors)
- Ruler (Transparent, 12 inch)
- Sample pictures of prehistoric hand images (Available through a library or a variety of art/history resources).
- Visual of TI-83 Graphing Calculator keys (attached)

Per Student:

- TI-83 Graphing Calculator
- Graphing paper (size 8.5 x 11 inches)

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

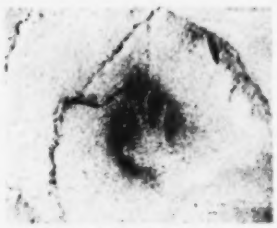
- Pencil
- Ruler
- Worksheets: " Vocabulary Terms;" "Table of Coordinate Points" (attached)

Attach the TI-83 with the overhead screen adapter to the overhead screen and place on the overhead projector. Test to ensure that the projection is as large as possible, unobstructed, and focused. Clear all graphing calculators of previous work and set to the "home screen." If a *Graph Link* is available, set up the link on the computer by installing the *Graph Link* software, and ensure that the printer works with the printer and is stocked with paper. Use the "Get Screen" feature to check that it is correctly attached to the computer, and using the correct port assignments.

Graph paper should be ready to distribute to students. Summarize the objectives and key vocabulary in written form on a medium visually available to the students.

Preparatory Activities

Show visuals such as pictures of hand painting from prehistoric times to the class to demonstrate how people like us from a very different time used images to leave their personal mark for many thousands of years. Say: Today, we will also leave our personal mark in a digital medium. This digitized image can be changed and adapted in many ways, and serves as the basis for an entire field of digital modeling, such as that seen in film and in research.



http://www.culture.fr/culture/arcnat/chauvet/en/gvpda-d.htm

Check for prior knowledge: Ask students to identify example of images and effects in the movies and on television that they may have seen that would be examples of digitized images. Ask how they think that they could digitize a flat image.

Direct students to targeted concepts: Explicitly state the objectives as written and tell how they will be assessed (see in assessment section). Distribute the vocabulary worksheet and introduce the key vocabulary terms:

- Coordinate Pair
- Coordinate Plane
- Digital
- Dilation
- Menu
- Pixel
- Quadrant
- Reflection
- Resolution
- Rotation
- Scatter Plot
- Transformation
- Translation
- X axis
- Y axis

The lesson:

1. Have students keep their vocabulary sheets available to write the meanings of terms as they are used in the remainder of the lesson. Vocabulary words are highlighted in the following steps when they are explicitly first used for the time.

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

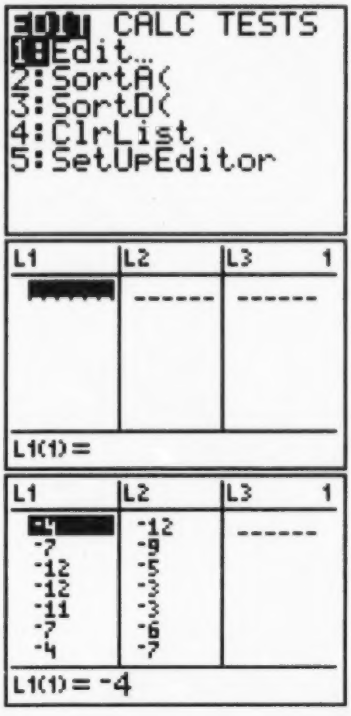
2. Put an overhead transparency that shows a square array. Model construction of the **coordinate plane**, made up of a **x-axis**, a **y-axis**, and four **quadrants**. Have students make their own coordinate planes in the same manner. Move around the room to monitor progress.

3. Place a hand flat on the overhead in a way that fits within the viewable part of the graph, and is present in all four quadrants. Trace the image with an overhead marker and pull the hand away. Students will then perform the same task. Move around the room to monitor progress.

4. Once the tracing is on the graph or coordinate plane, model selection of at least fifteen points on the tracing that will help in the selection of **coordinate pairs** as the image is transferred from a tracing into a **digital** form. These points are then assigned coordinates that are accurate to the nearest half, and recorded on the "Table of Coordinate Points" worksheet in decimal form (e.g. 12.5, -5). While the minimum number of points is fifteen, extra points can be used to improve **resolution**. After the final point is entered, the first point should be entered afterwards to return the sequence to its starting point. (This will enable the creation of a closed image). Students will then perform the same task. Assist the students where needed.

5. At this point, the students are ready to put the information into the graphing calculator. Remove the transparency in use, and put the TI-83 overhead screen on the projector. Refocus as necessary. Turn the overhead-linked calculator on, and press the **[STAT]** button. Use the poster of the TI-83 Graphing Calculator keys to show the students exactly which button to push.

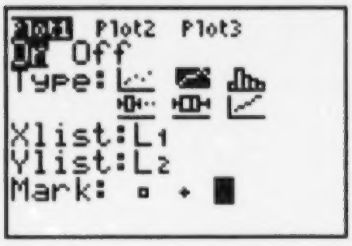
6. The students will then see a **menu** both on their calculators, and on the overhead display. Use the cursor key to select **"1: EDIT..."** and press **[ENTER].** Store ordered pairs from the "Table of Coordinate Points" worksheet by entering the x coordinates in **L1** (list number one) and the y coordinates in **L2** (list number two). Students will need some time and guidance to perform this function. Those that finish early can help those that need it. Note: It is important that every number in **L1** have a corresponding entry in **L2** to avoid a "mismatch error" during graphing.



BEST COPY AVAILABLE

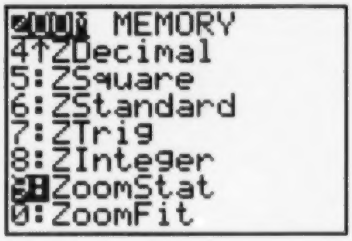
Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

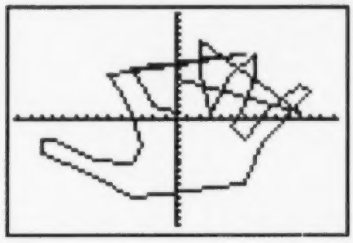
7. As a class, press **[STAT PLOT]** (**2nd**, **Y=**) and select **"Plot 1."** Select **"On"** and choose the **scatter plot** graph that shows the points connected (the second graph on the top row). The **"Xlist"** is used to identify the list from which the x-coordinates will be selected, and should show **"L1."**

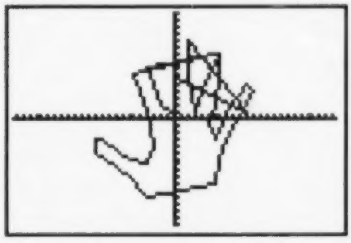


If it does not, move the cursor to the entry and press **[L1]** (**2nd**, **1**). The **"Ylist"** is used to identify the list from which the y-coordinates will be selected, and should show **"L2."** If it does not, move the cursor to the entry and press **[L1]** (**2nd**, **2**). Finally, move the cursor to select the **"Mark"** by placing it on the "." and pressing **[ENTER].** Students will need some time and guidance to perform this function. Those that finish early can help those that need it.

8. As a class, press **[ZOOM]** and select **"9:ZoomStat"** followed by **[ENTER]**. The calculator will select a "window" in which the data will fit, and graph the result using a connected scatterplot. A form of a hand should appear on top of a pair of axes. The image will look jagged because of the limited number of individual **pixels** used in the screen array. The calculator "window" will stretch the image vertically or horizontally and can be corrected by selecting **"5:ZoomSquare"** followed by **[ENTER].** A smaller, but truer image will result.







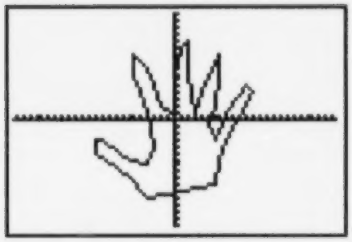
9. Errors in data input will result in stray points that will alter the image. These can be corrected by using visual cues to identify which point(s) in the sequence are incorrectly assigned. Students will troubleshoot their results by first looking at their graphs, rechecking their coordinates, and verifying correct recording in the worksheet "Table of Coordinate Points."

10. Where changes are made, or if there are no discrepancies in the initial work, students will next go to the lists in the graphing calculator. Students will press **[QUIT]** (**2nd**, **MODE**) to return to the "home screen," and retrace their steps as described in sections five and six above. They will not need to reenter all the data, but can instead move the cursor through the lists and correct errors by overwriting erroneous entries.

BEST COPY AVAILABLE

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

11. Upon completion they should repeat the steps described in section eight. If this corrects the errors, then they are ready to proceed to the next step. If not, they will repeat the troubleshooting process. Students will need some time and guidance to perform this function. Those that finish early can help those that need it.



(The following steps twelve through sixteen can be omitted if there is no need to continue with transformations. They can also be deferred to a subsequent lesson if the class only lasts forty minutes. In that case, the data will have to be retained in the calculators, and students will resume their work with the same calculator the next lesson. The programming feature can also be used to store the work under unique filenames, allowing other classes/sections to use the calculators in the interim. These procedures are described in the attachment "Saving Student Work through Programming.")

12. Once the hand image is correctly displayed, the data can be manipulated to **transform** the image. The original data in **L1** and **L2** will be retained, and **L3** and **L4** will be used for future plotting. From the home-screen, (if not on the home-screen, press **[QUIT]** (**2nd**, **MODE**)) press the **[STAT]** button. Use the cursor key to select "**1: EDIT…**" and press **[ENTER]**. Move the cursor to **L3** and then up to the top of the column.

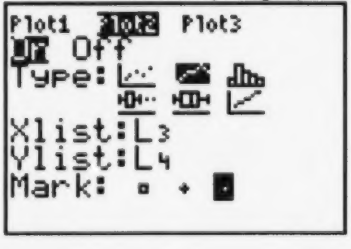
L1	L2	L3 3
-4	-12	------
-7	-9	
-12	-5	
-12	-3	
-11	-3	
-7	-6	
-4	-7	
L3 =		

In the display shown at the bottom of the screen, key in "**L1*2**" and press **[ENTER]**. Move the cursor to **L4** and then up to the top of the column. In the display shown at the bottom of the screen, key in "**L2*2**" and press **[ENTER]**.

L1	L2	L3 3
-4	-12	------
-7	-9	
-12	-5	
-12	-3	
-11	-3	
-7	-6	
-4	-7	
L3 =L1*2		

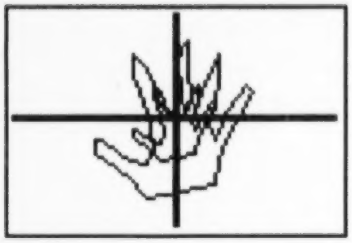
L2	L3	L4 4
-12	-8	------
-9	-14	
-5	-24	
-3	-24	
-3	-22	
-6	-14	
-7	-8	
L4 =L2*2		

13. As a class, press **[STAT PLOT]** (**2nd**, **Y=**) and select "**Plot 2.**" Select "**On**" and choose the scatterplot graph that shows the points connected (the second graph on the top row). The "**Xlist**" is used to identify the list from which the x-coordinates will be selected, and should show "**L3.**" To do this, move the cursor to the entry and press **[L3]** (**2nd**, **3**). The "**Ylist**" is used to identify the list from which the y-coordinates will be selected, and should show "**L4.**" Move the cursor to the entry and press **[L4]** (**2nd**, **4**). Finally, move the cursor to select the "**Mark**" by placing it on the "**.**" and pressing **[ENTER]**.



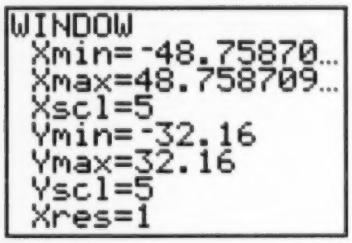
Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

14. Press **[ZOOM]** and select **"9:ZoomStat"** followed by **[ENTER]**. A larger form of a hand should appear on top of the first image. The calculator "window" will stretch the image vertically or horizontally and can be corrected by selecting **"5:ZoomSquare"** followed by **[ENTER]**. A truer image will result. Students should observe a larger hand around the original image. The new image is a **dilation** of the original by a factor of two.

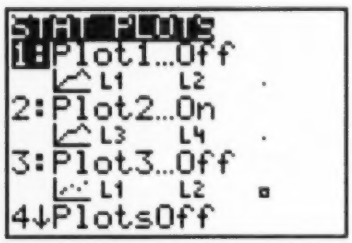


The axes look bolder because the unit scale markers run together as the picture zooms out. To make the picture and the scale clearer, it is necessary to go to select the **[WINDOW]** screen and modify the displayed scale.

The **Xscl** (X Scale) and the **Yscl** (Y Scale) can be modified from 1 to 5 as shown. Press **[GRAPH]**, and the modified axes will be shown.



Additional transformations can be made clearer by turning Plot1 off through the **[STAT PLOT]** screen.



This transformation can be repeated with factors in various forms by having students work in pairs or small groups with some or all of the following factors. At a minimum, each student pair/group should successfully dilate the image using one factor greater than one, one between zero and one, and one less than zero. Students should turn **Plot1** on to contrast the initial image with its transformation and off the see the transformation with greater clarity. This will allow the students to further master the display features of the graphing calculator.

Percentage (rates of change):

- +100% ? **L1*2, L2*2**
- +150% ? **L1*2.5, L2*2.5**
- +200% ? **L1*3, L2*3**
- +50% ? **L1*(150/100), L2*(150/100)** or **L1*(1.5), L2*(1.5)**
- -50% ? **L1*(50/100), L2*(50/100)** or **L1*(.5), L2*(.5)**
- -100% ? **L1*-1, L2*-1**

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

BEST COPY AVAILABLE

Fractions and decimals (ratios of scale):

- 2/3 ? **L1*(2/3), L2*(2/3)**
- 3/2 ? **L1*(3/2), L2*(3/2)**
- 1/2 ? **L1*(1/2), L2*(1/2)**
- -1/2 ? **L1*(-1/2), L2*(-1/2)**

- 3.75 ? **L1*3.75, L2*3.75**
- 2.5 ? **L1*2.5, L2*2.75**
- -2.5 ? **L1*-2.5, L2*-2.5**
- -1 ? **L1*-1, L2*-1**

Demonstrate some examples of dilation in various scales and allow students to share their results. Dilations of –1 or –200% result in a **rotation** of 180° of the image about the origin and should be demonstrated to enable visualization of the process.

15. The next transformation to be analyzed is **reflection**. This is accomplished by reversing the signs or positions of the coordinates. Again, **L3** and **L4** will hold the altered coordinates. The following reflections can be accomplished by multiplying **L1** and **L2** and placing them in **L3** and **L4** as listed:

- Reflection across the x-axis ? **L1, L2*-1**
- Reflection across the y-axis ? **L1*-1, L2**
- Reflection across the line y=x ? **L2, L1**
- Reflection across the line y=x ? **L2*-1, L1*-1**

Demonstrate some examples of reflection and allow students to share their results.

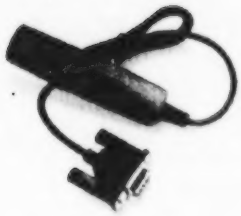
16. The final transformation to be analyzed is **translation**. This is accomplished by adding or subtracting a constant from the x-coordinate, and adding or subtracting another constant from the y-coordinate. Applying these constants to L1 and L2 and placing them in L3 and L4 as listed can accomplish the following translations:

- Translate 12 **right** and 10 **up** ? **L1+12, L2+10**
- Translate 15 **right** and 9 **down** ? **L1+15, L2-9**
- Translate 14 **left** and 14 **up** ? **L1-14, L2+14**
- Translate 8 **left** and 10 **down** ? **L1-8, L2-10**

Students should select other examples and share their results.

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

17. Turn off plot 2 if it has been used. Re-zoom and use the format key to remove the axes.



18. Teachers who are experienced with the Graphing Calculator may choose to use a *Graph-link* to transfer some or all of the images to the computer. Paste these in a drawing or picture software page for later modification. Exceptional examples can be printed out or modified through image editors such *Paint Shop Pro*, or *Aldus Photostyler*.

BEST COPY AVAILABLE

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

Assessment

Assessment is based on teacher observations of student progress through the lesson. Since the main task is a performance task, any student that can display an accurate image of their hand on the graphing calculator, and then perform transformations as directed has demonstrated mastery of the objectives.

A checklist can be maintained to note the successful mastery of these skills during or after the lesson. The vocabulary lists will be collected and assessed for completeness and accuracy. Writing components such as a journal response or a short essay on what the student did and learned supports literacy across the curriculum and consolidates the learning process.

Action Plan: Culminating Activities

- Transfer the image and/or the data to the computer using *Graph Link* if available.
- If *Graph Link* is not available, the data from the tables can be transferred by hand to *Geometer's Sketchpad* for further analysis and increasingly responsive and sophisticated transformations.
- Manipulate the images saved using graphics software to look like the original hand paintings or make creative images for display.
- Prompt the students to think again about how digital effects are used in the mass media. Have them find examples in magazines, video, and film, and share these in the next class session.

Extensions

Videos that support this topic and further math/computer extensions are:

Life by the Numbers, **Educational Highlights Video**
http://www.ti.com/calc/docs/mathlife.htm

The two-hour Educational Highlights video, available through the ITS programming at WNVT Channel 53/56, features over a dozen individual segments, each five to 10 minutes, selected from the series.

Bill Nye the Science Guy, Episode 78 **COMPUTERS**
http://disney.go.com/DisneyTelevision/BillNye/index.html

A portion of the program is especially well suited to describing the binary coding inside a computer and how it can be used to created digital images of letters and numbers, that are displayed and used every day on a computer monitor.

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

The Internet can be used to assist teachers in identifying resources for the lesson and opportunities for support to include class-sets of calculators available for loan, and additional lessons and instructional ideas. These include:

http://www.pbs.org/wqed/lifebythenumbers/standard/
http://www.ti.com/calc/docs/mathlife.htm
http://www.ti.com/calc/docs/activities.htm
http://www.keypress.com/sketchpad/

History

The cave paintings of Southern France have left a lasting impression of early human experience. When did these people live, and where did they come from?

Language Arts

"Digitizing" an image, means creating a record of numbers that can be used as instructions to recreate the image in a different medium. Examine the vocabulary links between the digits as used numerically, and as a way to describe fingers and thumbs. Find similar connections in five more of the vocabulary words by explaining what each means in mathematical and everyday usage, where the words come from, and why there is a connection.

Science

Describe at least two situations in which digitized information can be used to model scientific phenomena. What are the advantages and limitations of these models?

Art

What other paintings were made by prehistoric man? How did they make such stunning pictures in the darkness of the caves? Why did they go through so much trouble to express what they saw in art? How do computer graphics expand our scope and appreciation of art today? Combine the work you have created as a class into a collage that uses the colors and forms of prehistoric art. Extend it to new adaptations gradually, or on a separate work to create a more modern look.

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

Vocabulary List

Define the following terms as they are used in the lesson:

Coordinate Pair

Coordinate Plane

Digital

Dilation

Menu

Quadrant

Reflection

Resolution

Rotation

Scatter Plot

Transformation

Translation

X-axis

Y-axis

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

Table of Coordinate Points
(Converting Pictures to Digits)

Point Number	X Coordinate	Y Coordinate
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

BEST COPY AVAILABLE

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

Assessment Rubric:

Vocabulary

- ❑ All definitions have been completed
- ❑ Definitions are accurate
- ❑ Definitions are clear
- ❑ Definitions are written in complete sentences

Coordinate Graph

- ❑ Axes are drawn using a straightedge
- ❑ Axes are labeled
- ❑ Axes have arrows at both ends
- ❑ A scale is provided on both axes
- ❑ All four quadrants are labeled
- ❑ The tracing covers all four quadrants
- ❑ Points are clearly drawn

Data Collection Sheet

- ❑ At least fifteen points are recorded
- ❑ X and Y coordinates are correctly identified

Graphing Calculator

- ❑ Lists 1 and 2 are used effectively
- ❑ The image is scaled to show the entire hand
- ❑ The image is closed
- ❑ The image correctly reflects the data from the tracing

Total score (out of 17): ____ /17

Leonard Bumbaca
Annandale High School
Fairfax County Public Schools
Fairfax County, Virginia

SE065864

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: **Give Me a Hand! Digitizing Images into a Graphing Calculator Using Coordinate Geometry**

Author(s): **Leonard E. Bumbaca**

Corporate Source:	Publication Date:

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2A documents	The sample sticker shown below will be affixed to all Level 2B documents
PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 1	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2A	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2B
Level 1 Yes	Level 2A X	Level 2B X
Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) and paper copy.	Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only.	Check here for Level 2B release, permitting reproduction and dissemination in microfiche only.

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, please

Signature: Leonard E. Bumbaca	Printed Name/Position/Title: Leonard E. Bumbaca, Teacher (Secondary Math)	
Organization/Address: Fairfax County Public Schools, 6815 Edsall Road, Springfield, VA 22151	Telephone: (703) 573-6931	FAX: (703) 426-3917
	E-Mail Address: lbumbaca@fcps.edu	Date: 5/1/2002

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, *or*, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

ERIC/CSMEE
1929 Kenny Road
Columbus, OH 43210-1080
E-mail: beckrum.1@osu.edu
FAX: 614-292-0263